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CODING AND FLOW CHARTING AS APPLIED TO UICSM PROGRAMED TEXTS (1962-1963 VERSIONS). COMPARATIVE STUDIES OF PRINCIPLES FOR PROGRAMMING MATHEMATICS IN AUTOMATED INSTRUCTION. TECHNICAL REPORT.

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Coding systems need to be developed to account for computer decisions on every frame of a self-instructional program. In flow charts of the UICSM high school math programed series, each frame or page is represented by a diagramatic convention: diamond if a mainline frame, a rectangle if a quiz frame, a bottom-heavy trapezoid if a review or remediation frame, or a top-heavy trapezoid if a skipping or by-passing frame. Frames are numbered, and some have reference numbers indicating structure originating from the page (branch, loop, or neither), location of the page within the general structure (within mainline or within remedial or enrichment loop or branch), number of paths originating on the page, and intended purpose of paths originating on the page. A four digit coding system is used. (BB)

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Lawrence M. Stolurow, Ellen Rosen and Clark Himmel

COMPARATIVE STUDIES OF PRINCIPLES FOR PROGRAMMING MATHEMATICS IN AUTOMATED INSTRUCTION

Technical Report No. 14

July, 1964

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COMPARATIVE STUDIES OF PRINCIPLES FOR PROGRAMMING MATHEMATICS IN AUTOMATED INSTRUCTION

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The technology of education requires the development of coding systems for the efficient handling and unambiguous processing of information about self-instructional program frames. For example, in a computerized teaching system such as SOCRATES (see Stolurow and Davis, 1964), it is necessary to prepare a library deck to tell the computer about each frame of a program in terms of decision outcomes. This means, for example, that the relevant and irrelevant response buttons need to be specified for every frame.

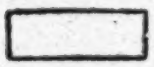
In a simple linear program only one button would be relevant and all others irrelevant. If the student pushes an incorrect button, nothing happens to the display; however, the error is counted as an error every time a response is made. Furthermore, none of the irrelevant buttons will stay depressed.

In a branching program, every alternative is associated with a button so that all the alternatives presented to the student as part of a frame need to be included in the library deck as acceptable responses. Since every one of those buttons is acceptable and all others are not, the latter subset must be rejected when pushed and the error counted. These requirements suggest the need for a system that maintains an accounting of computer decisions associated with every frame of a self-instructional program.

Method

Diagramatic Conventions

In preparing these flow charts certain conventions were adapted for purposes of standardization. One of these is the sign of a main line frame which is a diamond with a number in it, e.g.,

. A quiz is a rectangle, i.e.,  . As a shorthand device, three dots followed by an arrow indicate that the intervening frames were all like the preceding frame. Two forms for frames also were used: one, drawn , was to indicate review or remediation; the other, drawn , was used for skipping or "by passing." When pages are omitted the notational device used was ——>...——> .[1]

Code

The flow charts for the 1962-1963 edition of the UICSM High School mathematics programed series are given in the following pages. Each page and/or frame for booklets 101, 102, 103, 104, and 104 has been characterized by a four digit coding system. The first digit (which stands in the "thousands" place) indicates whether the page in question is the origin of a branch structure, a loop structure, or neither branch nor loop structure. If it is the origin of a branch structure, the first digit on the left is a one. If the page is the origin of a loop structure, the first digit is a two. If it is neither branch nor loop, the first digit is zero.

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[1] Common practice dictates that remedial frames and/or pages be diagrammed below and enrichment frames above the main line. As a further aid of the reader, this convention will be used in the following charts also.

The second digit (in the "hundreds" place) tells the location of the page; i.e., whether the page is located within the main line, within an enrichment sequence, or within a remedial sequence. If the page is within the main line (not included in a greater structure) the code number is a one, a two within a remedial branch, a three within a remedial loop, a four within an enrichment branch, and a five within an enrichment loop.

The third digit of the code (in the "tens" place) indicates the number of pathways by which it is possible to leave the frame. Thus, a frame which only has one means of exit will have a one in the third digit place. The last page in any booklet will have a zero in the third digit place.

The fourth digit (in the "units" place) indicates the character of branches and/or loops which originate on that page; i.e., whether the branch(es) and/or loop(s) contain enrichment or remedial material. If there are no structures originating on that page (other than a main line) the code number is zero. If there is a main line and a forward branch, the code number is a one. A main line and one or more enrichment paths is indicated by a two, a main line and one or more remedial paths by a three, a main line and one or more remedial paths plus one or more enrichment paths by a four, and no main line and one or more enrichment paths plus one or more remedial paths by a five.

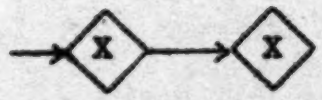
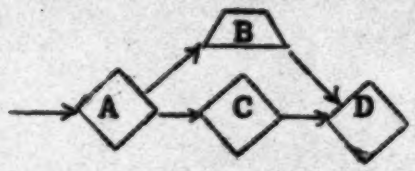
This code system is summarized in Table 1. There is room for improvement in this code system; a concept code number and a concept origin code number could be included in the system but, unfortunately, circumstances did not permit such an inclusion.

The reader should note that in the examples in Table 1, the page under consideration in the code is always page A ( ). In this flow chart system, the page numbers are encircled in diamonds to differentiate them clearly from the code numbers.

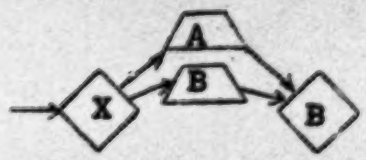
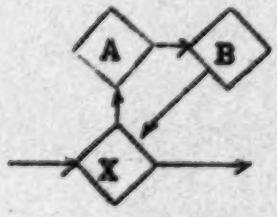
Table 1

Four Digit Numeral Codes for Paradigms

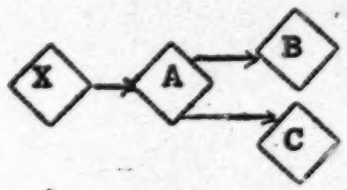
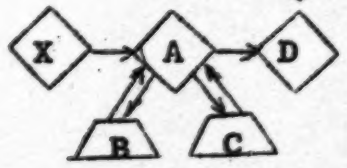
A. First digit indicates structure originating on page.

Structures	Code	Example
neither branch nor loop originates on the page	0	
branch originates on the page	1	
~~loop originates on the page~~ loop originates on the page	2	

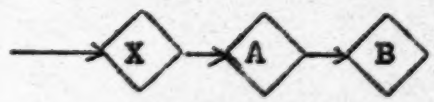
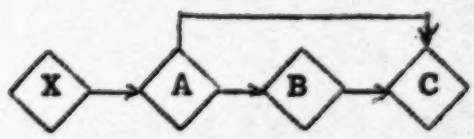
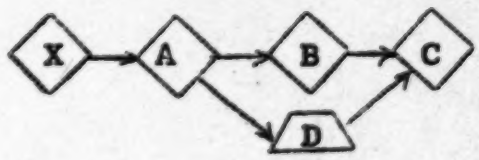
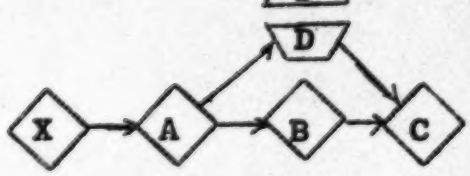
B. Second digit indicates location of the page within general structure.

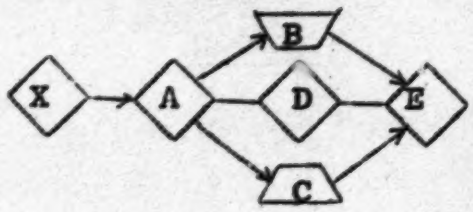
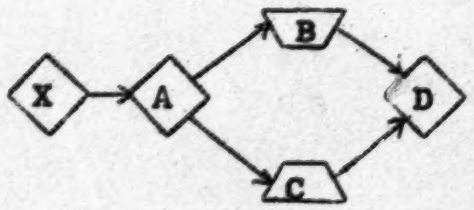
Location	Code	Example
within mainline	1	
within remedial branch	2	
within remedial loop	3	
within enrichment branch	4	
within enrichment loop	5	

C. Third digit indicates number of paths originating on page.

Number of Paths	Code	Example
none	0	
one	1	
two	2	
three	3	
and so forth		

D. Fourth digit indicates intended purpose of paths originating on a page.

Type	Code	Example
no material	0	
mainline	1	
enrichments	2	
remediation	3	
mainline and a forward skip	4	
mainline and remedial path(s)	5	
mainline and enrichment path(s)	6	

Type	Code	Example
mainline and remedial and enrichment paths	7	
remedial and enrichment paths	8	

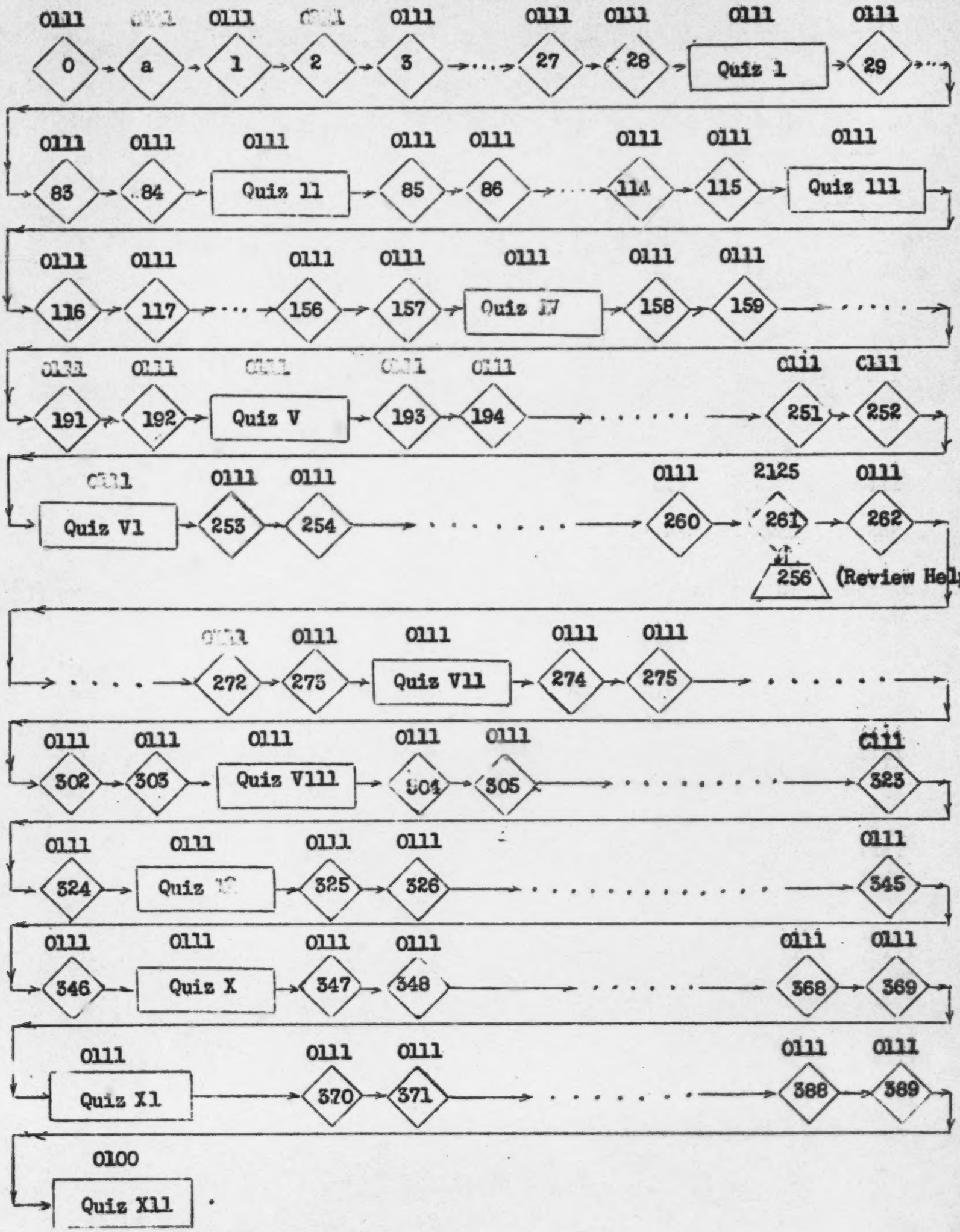


Fig. 1 Booklet 101 Flow Chart

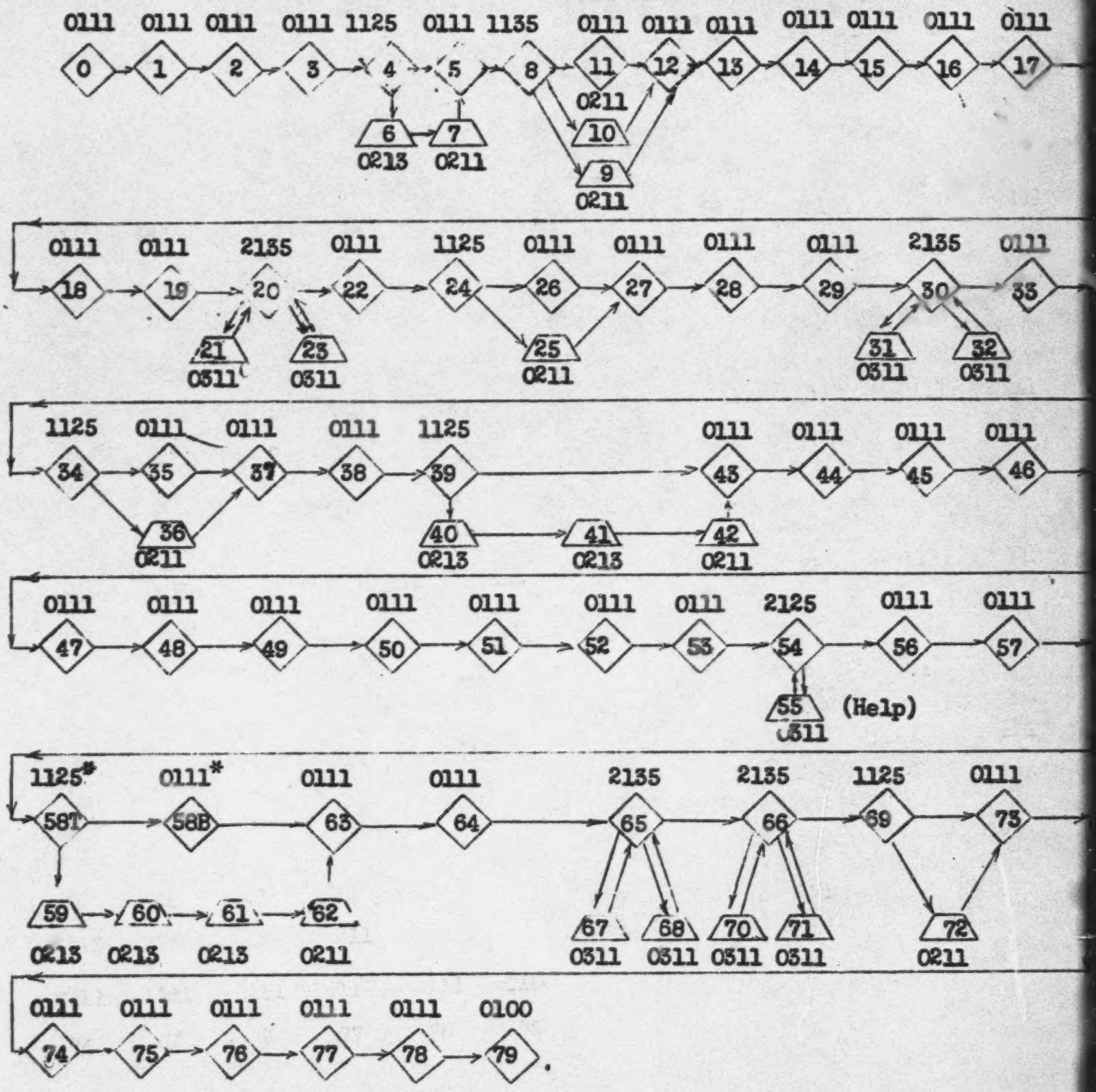
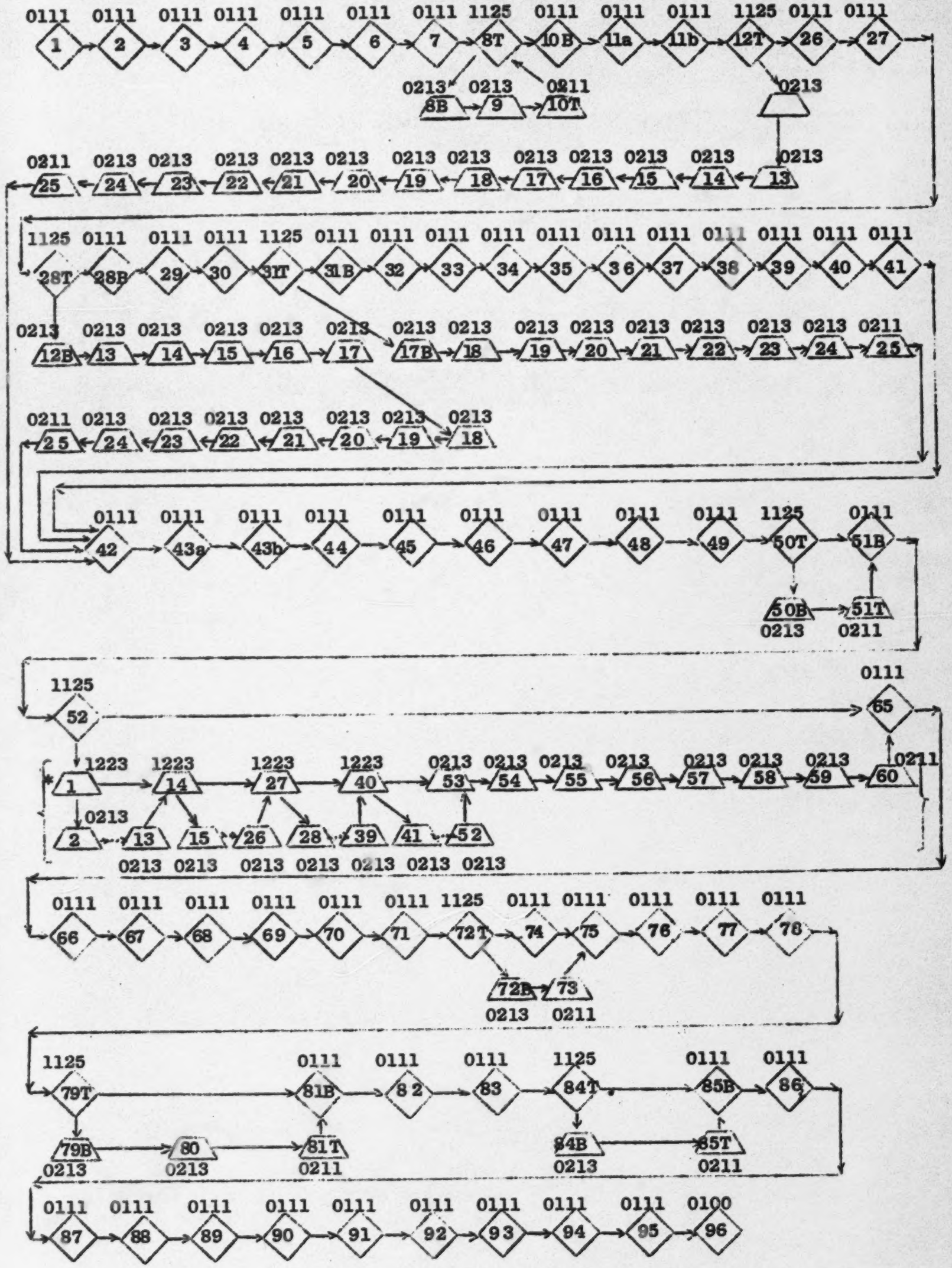


Fig. 2 Booklet 102 Flow Chart

* T: top of indicated page.

* B; bottom of indicated page.



*Item numbers herein are "zebra" frame numbers on pp. 53-64.

Fig. 3. Booklet 103 Flow Chart

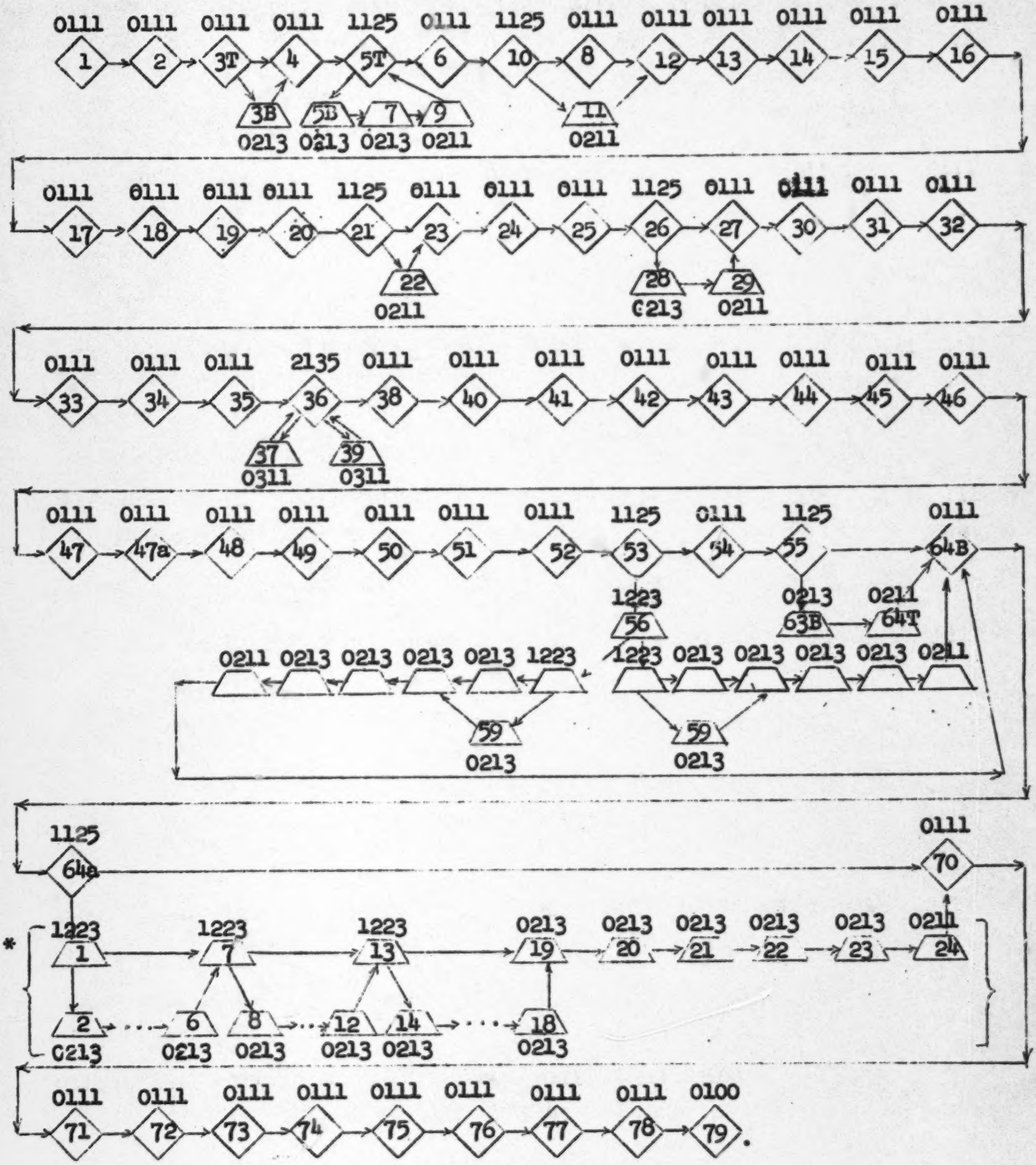


Fig. 4 Booklet 104 Flow Chart

* Item numbers herein are"zebra" frame numbers on pp. 65-69 (A-E).

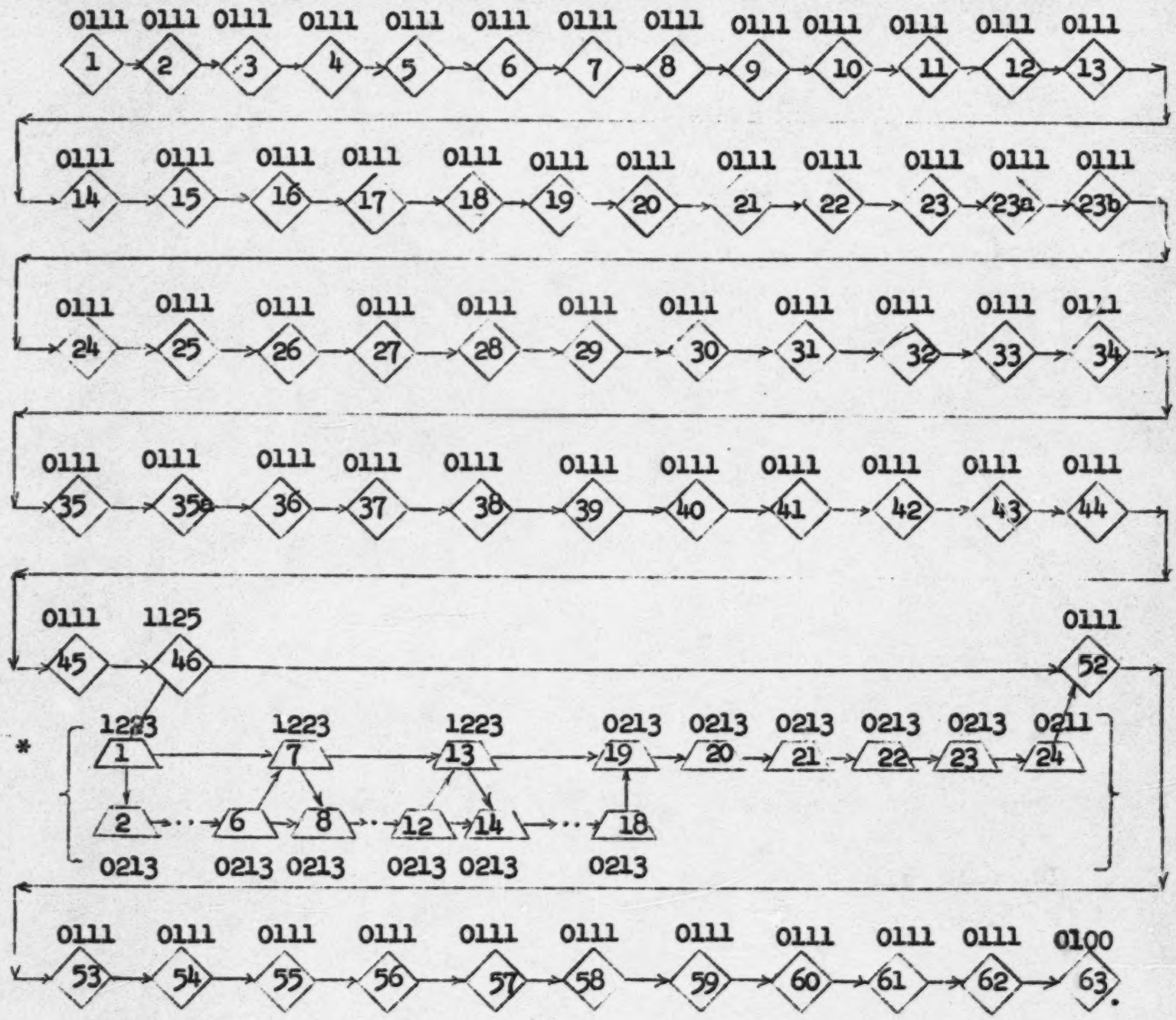


Fig. 5 Booklet 104 Flow Chart

* Item numbers herein are "zebra" frame numbers on pp. 47-51.

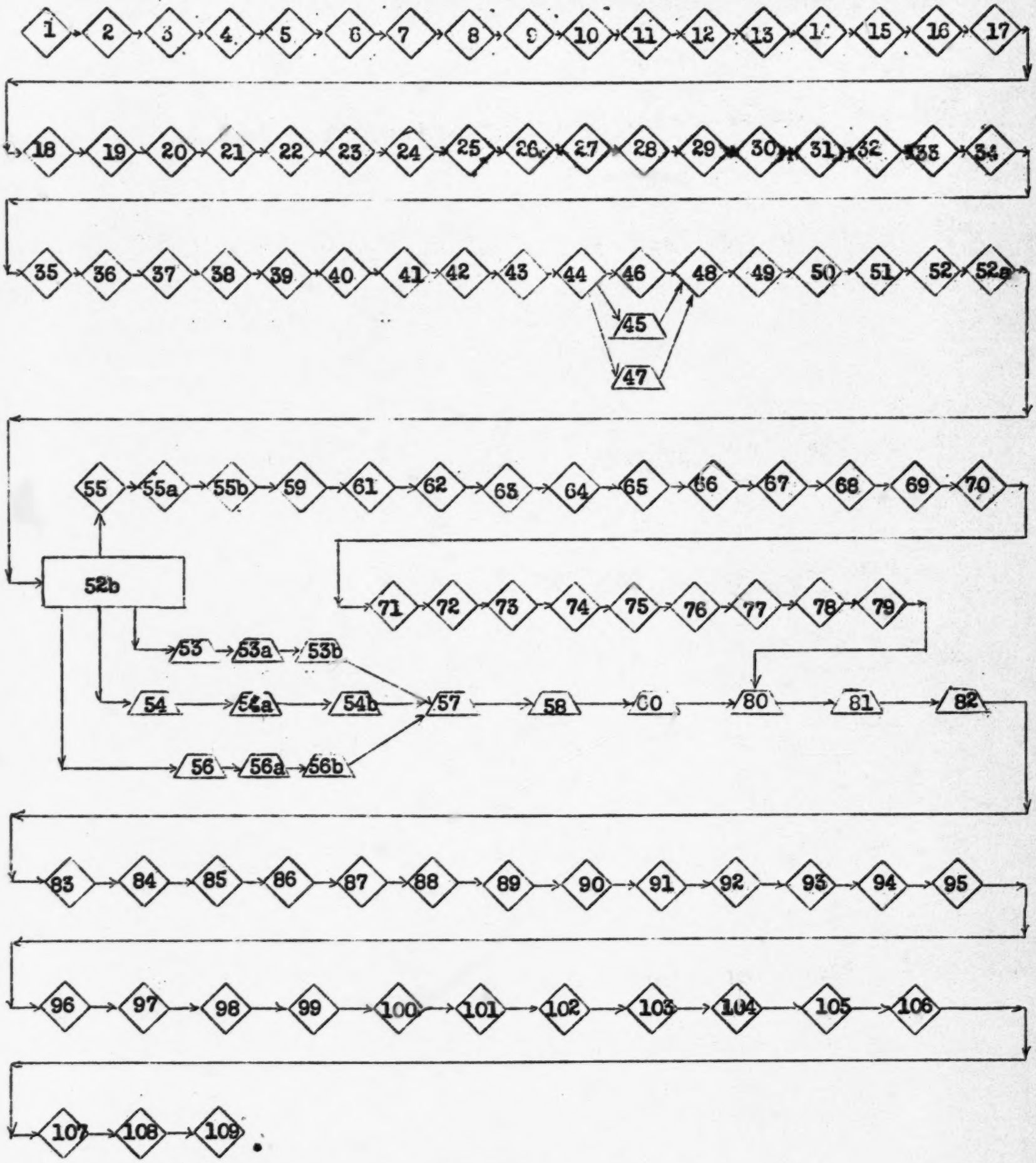


Fig. 6 Booklet 105 Flow Chart

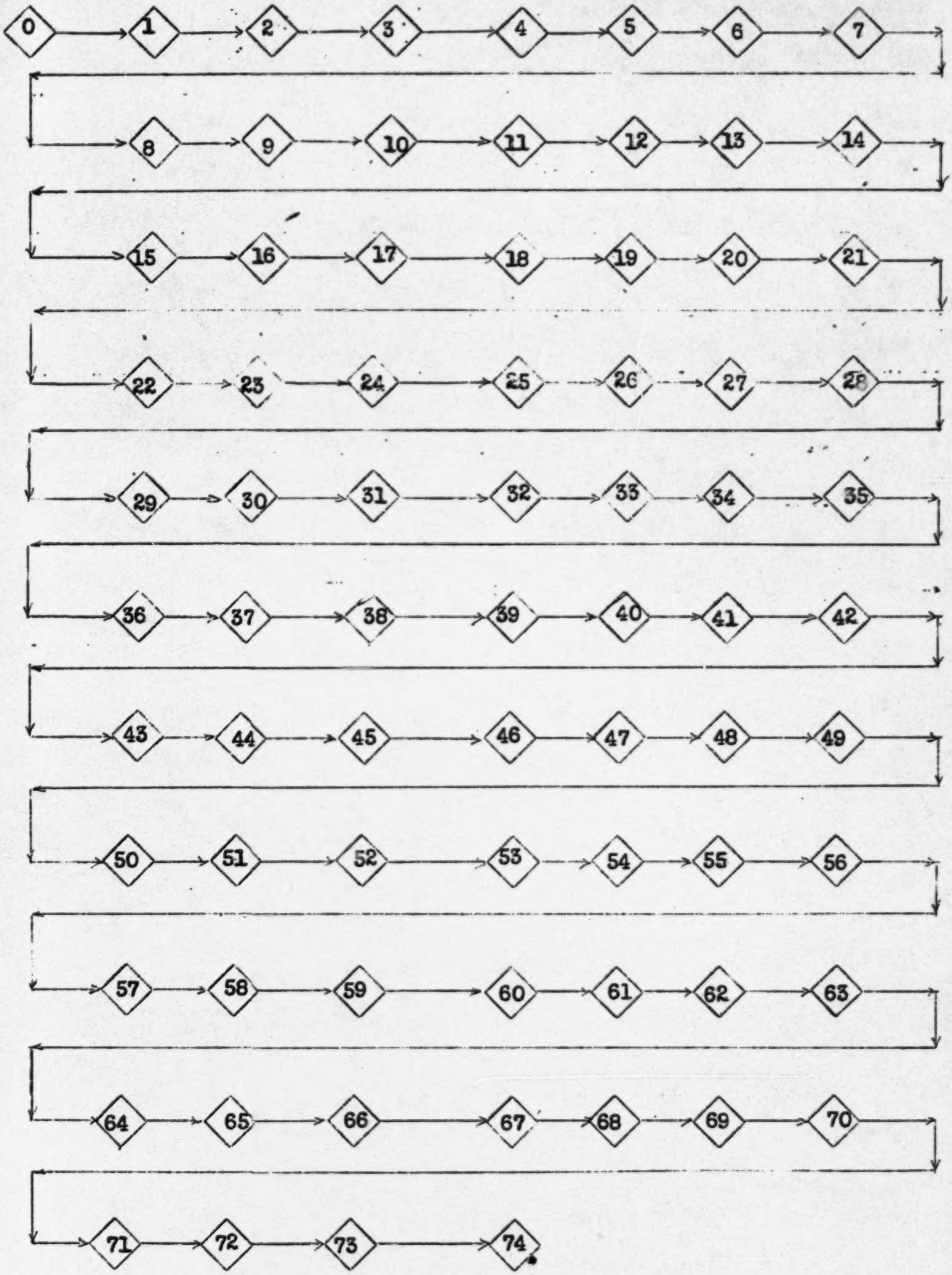


Fig. 7 Booklet 106 Flow Chart

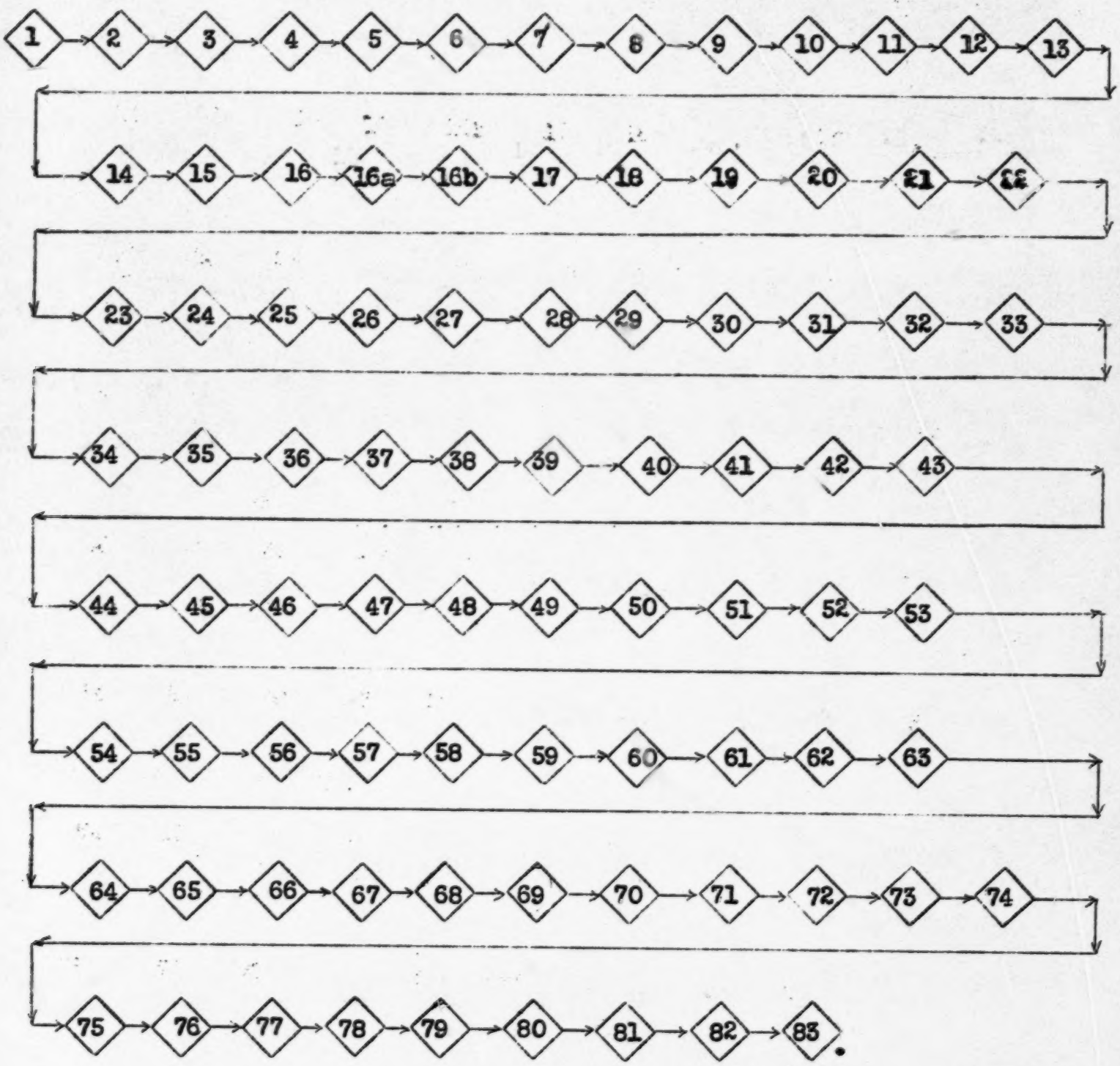


Fig. 8 Booklet 107 Flow Chart

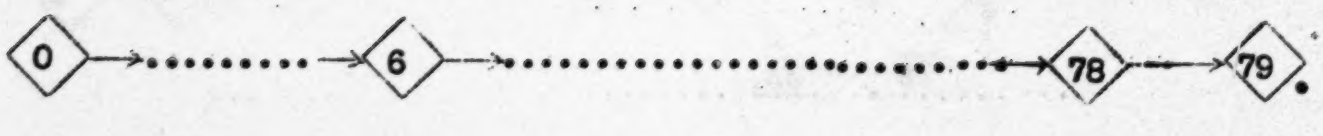


Fig. 9 Booklet 108 Flow Chart

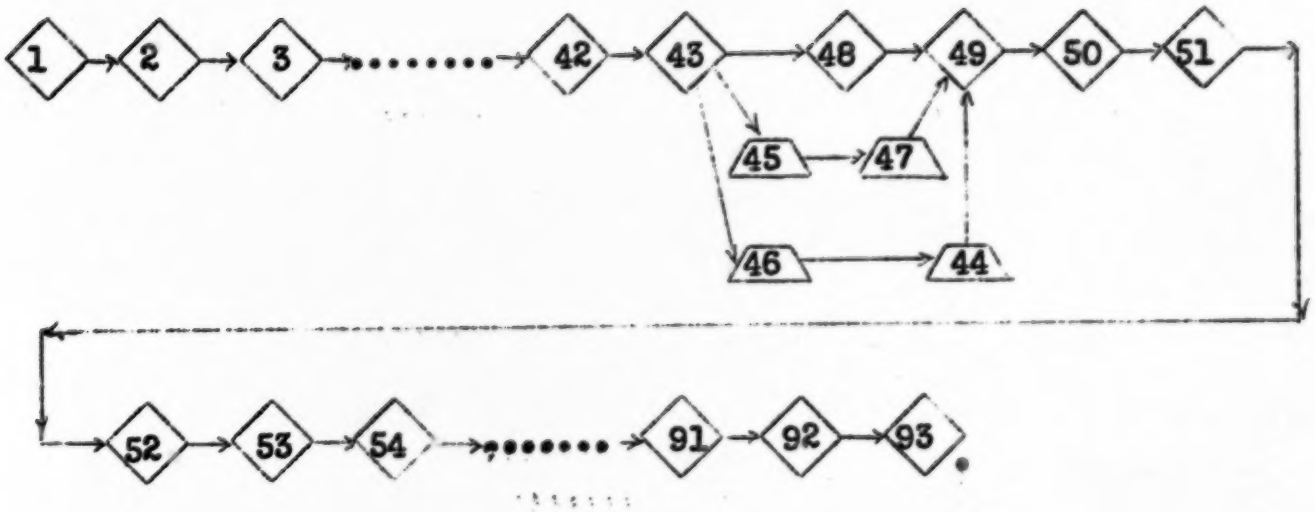


Fig. 10 Booklet 109 Flow Chart

Page 18 is missing

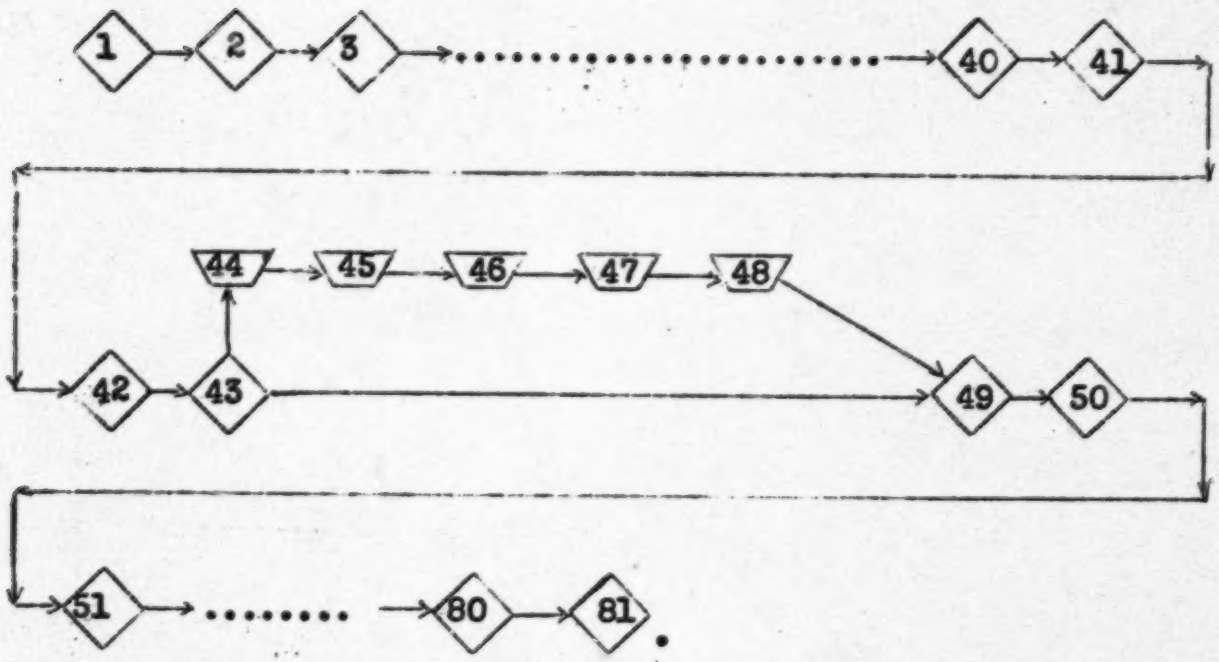


Fig. 12 Booklet 111 Flow Chart

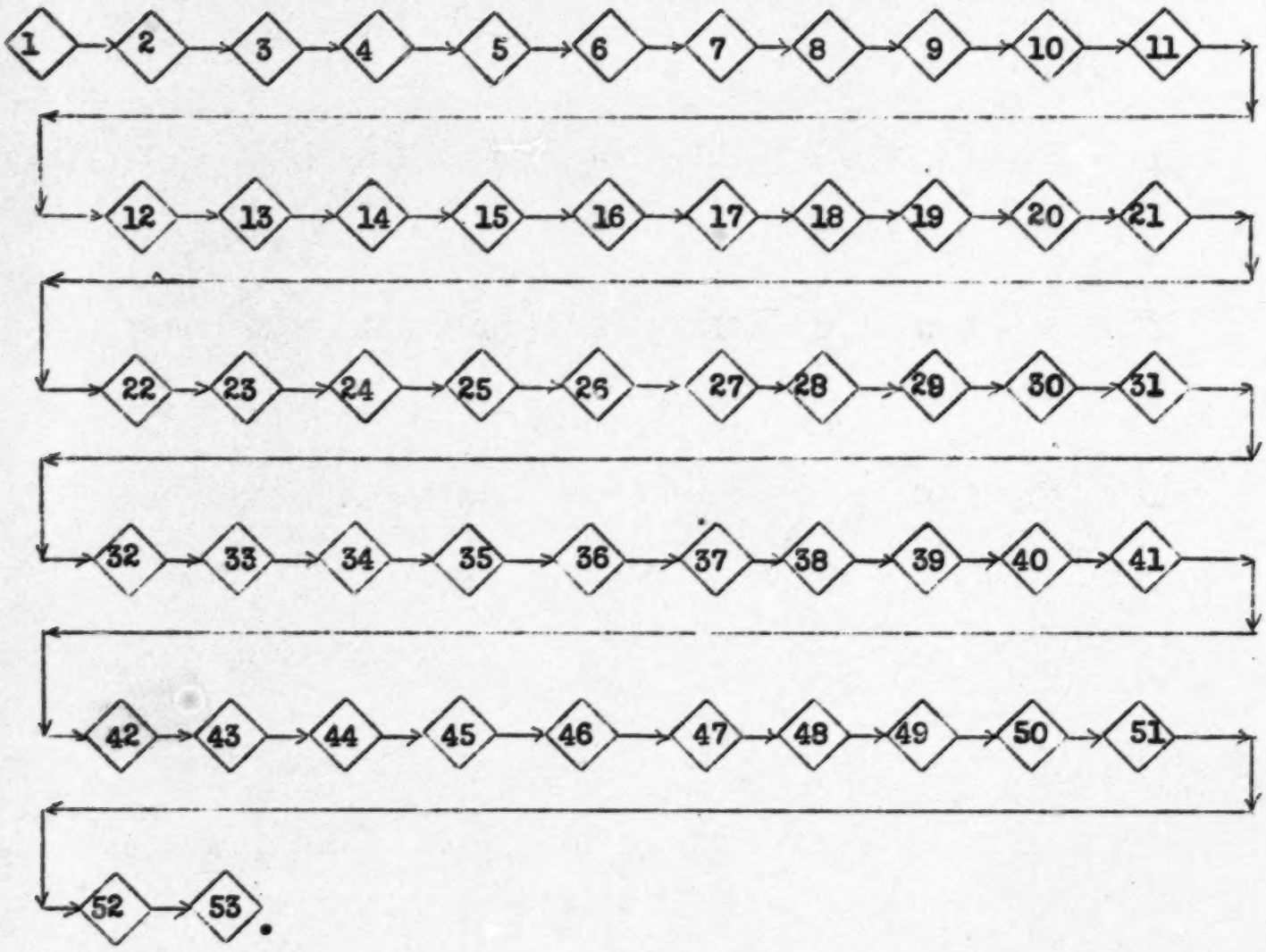


Fig. 13 Booklet 112 Flow Chart

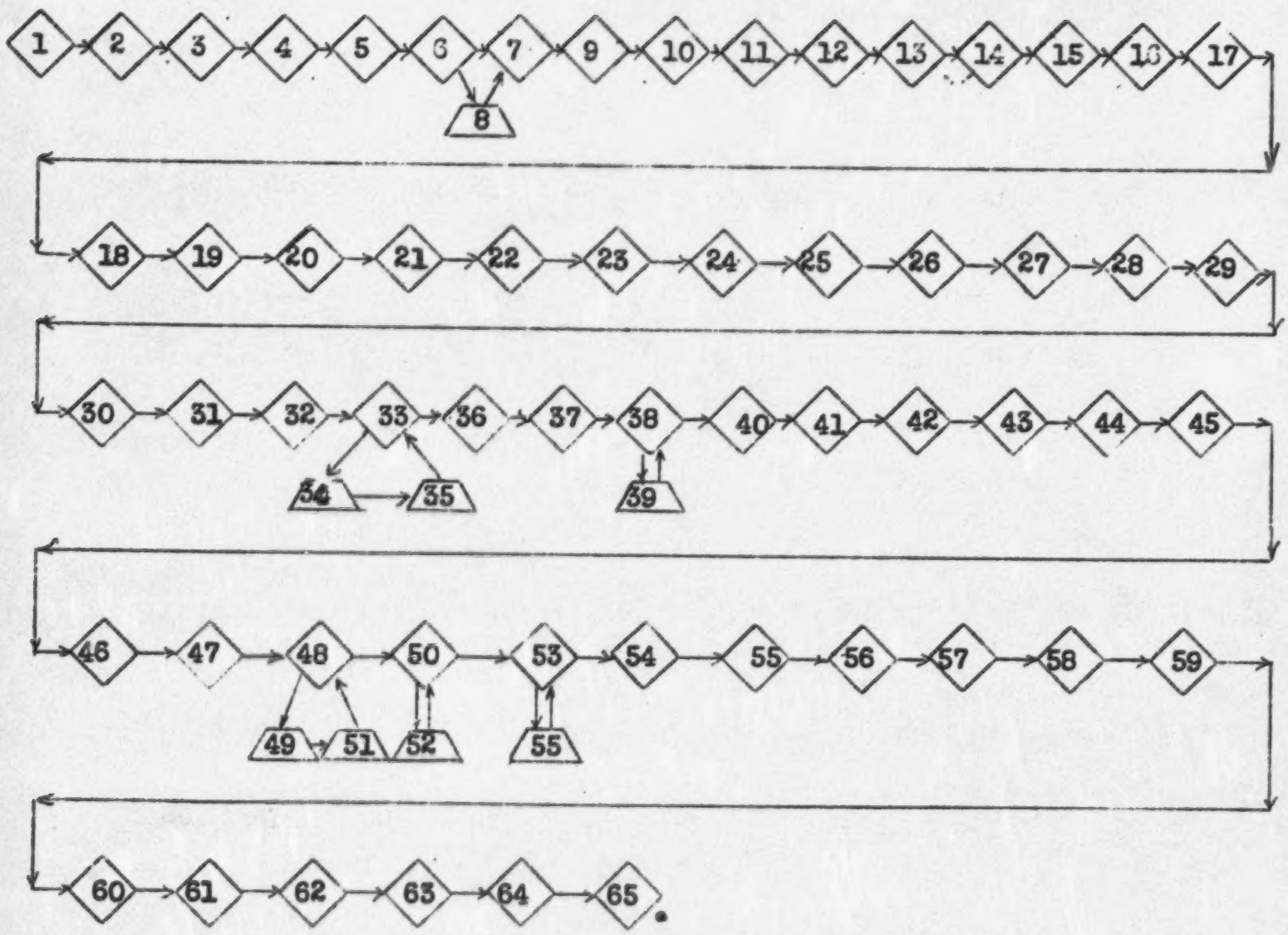


Fig. 14 Booklet 113 Flow Chart

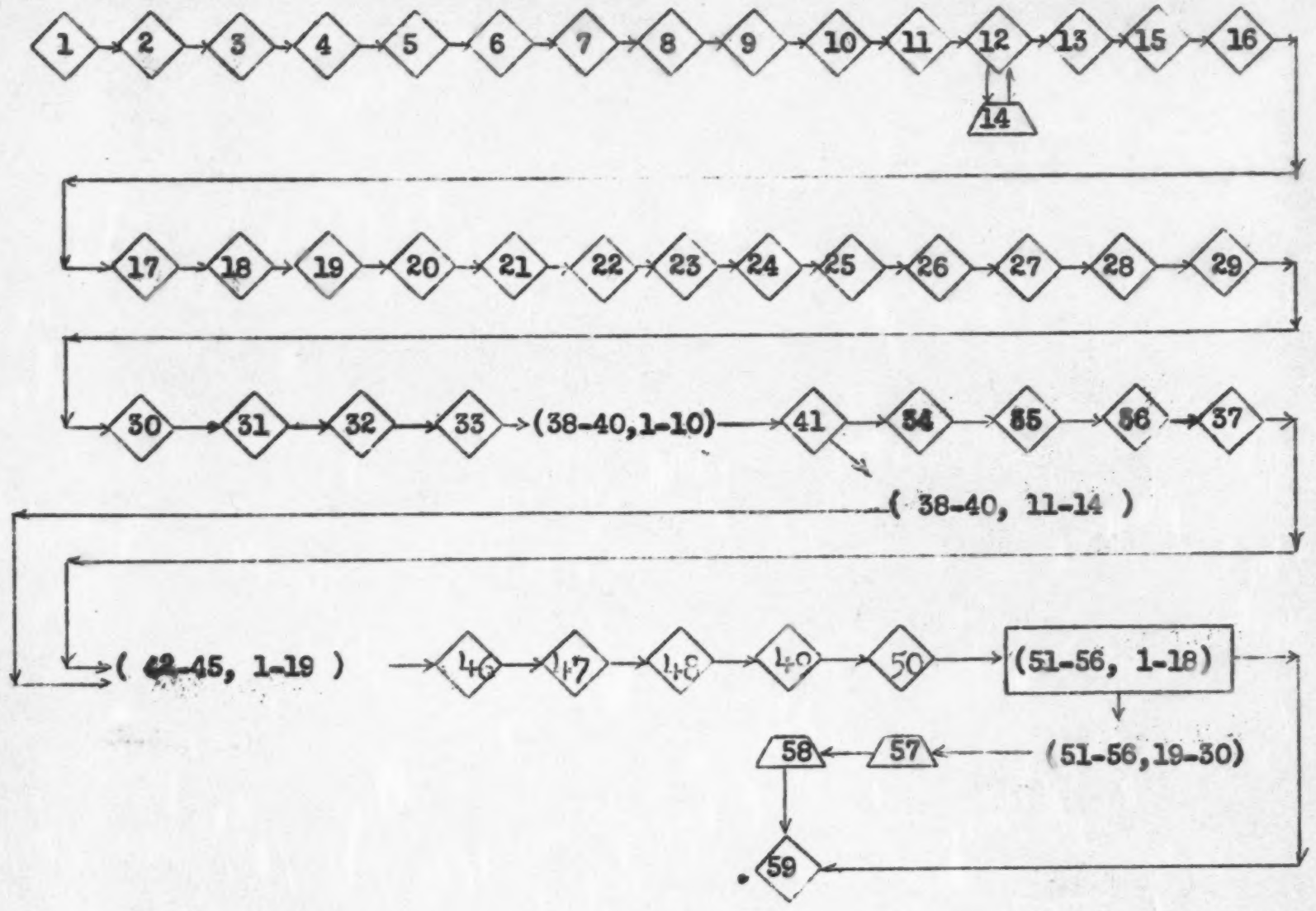


Fig. 15 Booklet 114 Flow Chart

Fig. 16 Booklet 114.5 Flow Chart

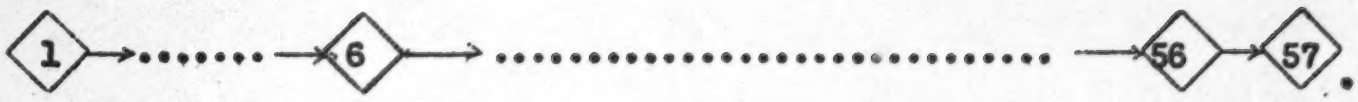


Fig. 17 Booklet 115 Flow Chart

Fig. 18 Booklet 116 Flow Chart